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The role of local ecological knowledge in sustainable urban planning: perspectives from Finland

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This paper is a study of the role of local ecological knowledge (LEK) as lay-expert knowledge in the urban land use planning process in Finland. The research addresses the importance of LEK, and the ways LEK is obtained and used. To obtain data, planning officials, biologists, and representatives of resident and nature associations were interviewed in the Helsinki metropolitan area. The results indicate that LEK exists among nature enthusiasts, as well as local residents, and planners can obtain the knowledge in several ways, most notably through networks of knowledgeable key informants and local nature associations. Considering LEK in urban planning is important because it complements scientific ecological data and indicates places important to locals. Some of the challenges of using LEK include collecting it through participatory planning processes, distinguishing it from other information, valuing subjective knowledge, and empowering planning officials to use LEK. To enhance communication between stakeholders, social scientists should be integrated in the planning process. Furthermore, technical improvements, such as registers of key informants and more efficient use of nature associations' knowledge, would be useful in applying LEK.

KEYWORDS: environmental planning, indigenous knowledge, land use, urban planning, environmental awareness, community involvement, social sciences

Introduction

The loss of green spaces as a consequence of urbanization challenges us to consider the importance of urban nature more closely. Although urban nature, in the industrialized countries, is not typically a livelihood resource to residents, it does provide essential ecosystem services, including direct use, as in environmental, recreational and psychological services (Vandruuff et al., 1995; Bolund & Hunhammar, 1999; Lankinen & Sairinen, 2000; Korpela et al., 2001), and in a wide array of educational and social services (Berkowitz et al., 2003; Sairinen & Kohl, 2004).

The use of ecological information in the urban land use planning process to preserve green spaces and ecosystem services for urban residents has gained acceptance (Sukopp et al., 1995; Niemelä, 1999; Kansanen, 2004). Presently in Finland, under the Land Use and Building Act of 1999, decisionmakers are required to base land use decisions not only on adequate ecological information from scientific studies, but also on the views and knowledge of local residents, nature enthusiasts, and

other user groups and participants, who can provide information on an area's biodiversity.

Local participation with regards to urban nature has the potential to enhance the sustainable development of communities and their green environments (WCED, 1987; Redclift, 1993), especially if participants connected to the green spaces become integrated in planning (Kline, 2001). The literature has recently recognized the importance of such participation, perceived as one dimension of linking ecological and human social systems to guide sustainable urban land use planning (Grimm et al., 2000; Alberti et al., 2003; Pickett et al., 2004; Grimm & Redman, 2004; Yli-Pelkonen & Niemelä, 2005).

Several studies suggest that supplementing scientific data with local and traditional knowledge can broaden the information base needed for better decisionmaking regarding ecosystem and sustainable resource management (Berkes & Folke, 1998b; Berkes et al., 2000; see also Scoones, 1999). Most studies of local ecological knowledge focus on indigenous or rural communities and their ecosystems (Berkes & Folke, 1998a; Huntington, 2000; Olsson & Folke, 2001; Berkes et al., 2003); however a few studies have addressed the potential

existence and use of such knowledge among urban ecosystem users (e.g. Colding et al., 2003). Barthel (2005), for example, addresses local ecological knowledge and participation from the perspective of adaptive co-management in urban parks. Devising a method by which local actor groups could make available their knowledge and thereby become an integral part of managing their urban ecosystem services of local green spaces would bring new dimensions to land use planning.

Local Ecological Knowledge

Local ecological knowledge (hereafter also LEK) refers to ecology as a natural science, and includes a person's general knowledge of nature and a more specific local knowledge. The concept can also be understood as lay or experiential ecological knowledge, which can be a blend of learned scientific knowledge and knowledge based on a resident's own observations and experiences from surrounding nature. As such, by definition, LEK is usually a hybrid and thus not strictly local or traditional (Clark & Murdoch, 1997; Nygren, 1999).¹ For instance, Olsson & Folke (2001) defined LEK in rural conditions as "knowledge held by a specific group of people about their local ecosystem" and "a mix of scientific and practical knowledge, being site specific and often involving a belief component." In our information society, science is omnipresent, and experiential knowledge is most likely influenced by scientific information (Folke et al., 2003). Urban residents, whether or not well educated, follow popular scientific journals, newspaper articles, and television programs to obtain information on urban nature and ecology. This can have a great impact when residents are observing and valuing urban nature.

When addressing local resident knowledge, it should be kept in mind that every interaction and interactor has a context and a background, and it is the context from which the construction of knowledge emerges. Furthermore, all knowledge is contextualized (Nowotny et al., 2001) and is a product of a social process (Hacking, 1999). Finally, local knowledge is usually strongly contextualized, containing elements such as experiences, beliefs, and fears that are dependent on the actors' roles in time and space (Kohl, unpublished; see also Hacking, 1999). Conversely, it should also be kept in mind that all research is contextualized (Nowotny et al., 2001), and scientific data can be weakly contextualized, for instance, when scientific experiments or measurements are done systematically and in controlled circumstances. With such weakly contextualized knowledge the author, time, or place do not have the same relevance as with strongly contextualized knowledge (Nowotny et al., 2001; Knorr Cetina, 1999).

Traditionally, expertise has been understood as emerging from a specific professional occupation or knowledge (Stehr, 1994), but according to Beck et al. (1994) institutional and scientific experts do not always know better, and strongly contextualized lay or experiential local knowledge can extend the concept of expertise (see Saaristo, 2000). In fact, who is an expert depends on the context (see Knorr Cetina, 1999) and each of us has much contextual expertise (Saaristo, 2000).

Unlike *ecological research information*, which includes precise scientific knowledge about species composition, diversity, habitat requirements and characteristics, and population sizes (Yli-Pelkonen & Niemelä, 2005), LEK is not a result of a systematic scientific study; its strength is in a lengthy series of local observations (Folke et al., 2003). It is essential to incorporate this type of knowledge in planning through participation.

Local Participation

The social science literature has broadly described ideas regarding local participation and its link to ecological modernization and global participation. Ecological modernization (as a political program, on one hand, and as a theory of social change on the other (Spaargaren, 2000)) has described new possibilities for citizen participation, but its challenges have also been widely recognized (Spaargaren, 1997). According to ecological modernization theory, the relationship between lay-actors (non-scientists) and experts (scientists), and the relationship between science and, for example, environmental policymaking, has undergone fundamental changes now that scientific uncertainties are no longer an internal matter for the scientific community (Spaargaren, 2000).

Furthermore, a potential enthusiasm for local participation can be seen as a reflection of global participation (Yearley, 1996). Global environmental problems (loss of biodiversity, pollution, etc.) as well as local crisis (such as natural catastrophes) that have worldwide effects on variable scales (see also Gunderson, 2003), have (with the help of global media) increasingly compressed the world. At least to some extent, global environmental problems are giving citizens, governments, and corporations a sense of global ties and of global identity for the occupants of spaceship Earth, which can make residents more willing to participate in the development of their local environment (Yearley, 1996).

Literature on public participation experiences in Finland (e.g. Paldanius, 1997; Kortelainen, 2000; Bäcklund, 2002; Koskiahio, 2002; Niemenmaa, 2002) has highlighted the challenges of local level participation. Urban planning situations have the same general challenges of local participation that Paldanius (1997) outlined. Key questions include: (a) who is able to participate, (b) what kind of attitudes and resources (knowledge, skills, and time) for participation do stakeholders (residents, associations, and land use planners) have, (c) are the right participatory methods used in relation to plan situations and participation objectives, and (d) how is local participation integrated into the land use planning and decisionmaking process.

One of the key issues in this study is the commitment with which lay people can participate in information production for decisionmaking. In order to understand lay people's role in the production and dissemination of scientific knowledge, Callon (1999) focuses on the diversity of possible modes of non-specialist participation in scientific and technical debates. He presents three models to address and clarify this issue; *the public education model* (M1), which "is based on the irreducible opposition between scientific and popular knowledge"; *the public debate model* (M2), in which lay people have different levels of knowledge and can to some extent participate in information production; and *the co-production of knowledge model* (M3), in which "lay people

¹ *Local* refers to those urban people who live in or near the area of concern, or are in intense interaction with the area (such as people who live further away, but use the area's recreational services).

are actively involved in the creation of knowledge concerning them.” This study uses these models as a framework to examine the real-life case of using LEK in an urban setting (Figure 1). The models are not necessarily contradictory, but, depending on the situation, can co-exist and complement each other.

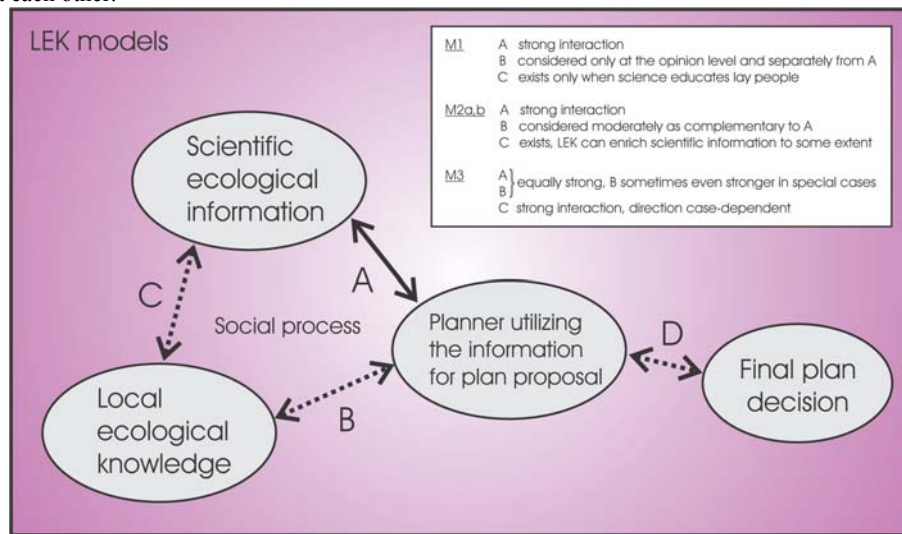


Figure 1. The relationship between Local Ecological Knowledge (LEK) and scientific ecological information in planning and decision-making can differ according to the models M1, M2 and M3 of Callon (1999). The arrows A, B, C and D depict the interactions between the elements, which are all part of the social process of planning. The dash lines of the interactions B, C and D illustrate their conditional existence.

According to Callon's **model M1**, the subjective LEK of lay people has nothing to contribute to objective scientific ecological information on which planning and decisionmaking is almost solely based (interaction A). Due to the prevailing mistrust between lay people and science, and in order to reduce this mistrust, and thus reduce critical opinions (interaction B) and reach rational decisionmaking, scientific experts have to intensify educational and informative actions towards lay people (interaction C).

According to **model M2**, local or lay knowledge, gathered by inquiries and public hearings from different actors or groups of actors, can enrich scientific expert information (interactions C and B), which forms a basis for planning and decisionmaking (interactions A and D), but even at its best is incomplete. Here this model is subdivided into **M2a** and **M2b** in order to better describe the different forms of participation (Kohl & Sairinen, 2004; Kohl, 2004). In **M2a** (called the **public hearing model**), planners hear local knowledge directly and genuinely from participants, and participation can influence the planning process. **M2a** illustrates the aim of the new participatory policy and, if this model is accurate, participation is working as the policymakers expected. However, even if participants are heard, there is a great risk that the participation still has a little influence on the final plan (interaction D).

In **M2b** (called the **public representation model**), local knowledge is heard, but indirectly through representatives of local participants. These can be, for instance, local resident or nature associations. Local knowledge has the potential to influence the planning process as well as in **M2a**, but the knowledge users have to remember that they are hearing the interpretation of the representatives. However, these representatives can potentially present the knowledge to users better than individual participants.

If the **model M3** proves to be the most appropriate for our case, then lay people have an essential role in the collective production of knowledge and scientific information (interaction C). With regards to planning and decisionmaking, LEK has become equally as strong as formal science (interactions A and B), or, in particular circumstances, has become more important (interaction B). This could happen, for instance, when scientific ecological information is scarce and LEK is perceived as an essential part of combined information production (see also Weber & Word, 2001). In all these models (such as in **M2**), it is possible that parts of both scientific information and local knowledge received by a planner through interactions A and B are lost in the process and may not be transmitted to the final plan (interaction D).

This paper's fundamental objective is to study the existence and the role of local ecological knowledge in Finnish urban areas, and to propose how it can be best used in the urban land use planning process as *lay-expert knowledge*.

The study focuses on Finnish urban development, specifically in the Helsinki metropolitan area, where a great deal of nature has been retained within and around an urban area due to flexible residential planning and building. The potential existence of LEK in the Finnish urban settings is substantiated by the long tradition of Finns living close to nature in rural conditions, where the use of natural resources for livelihood and recreation resulted in lay people acquiring a deep knowledge of nature (Kangas & Kokko, 2001; Relve, 2002). Although rapid urbanization after World War II changed this tradition, many Finns residing in urban areas still have a close relationship with nature and regularly use nature areas for recreation (Lankinen & Sairinen, 2000; Sievänen, 2001).

Based on the aforementioned framework, the following research questions are addressed:

- (1) Is LEK seen as an important factor in urban land use planning?
- (2) What types and categories of LEK can be identified?
- (3) What are the challenges associated with obtaining and using LEK in urban land use?
- (4) In what ways can obtaining and using LEK be enhanced during the planning process?

Methods & Data Gathering

The study area was the Helsinki metropolitan area in Finland, which is a densely populated urban area, with 76400 hectares (188792 acres) and 960,000 inhabitants. Within this metropolitan area, numerous parks, forests, lakes, rivers, seashores, and inner bays are extremely important recreational resources (e.g. Lankinen & Sairinen, 2000).

The data were collected using semi-structured expert interviews (Flick, 1998; Huntington, 2000), a partly informal, conversation-like method that may reveal matters unlikely to be discovered using such methods as questionnaires (Flick, 1998). Direct verbal and non-verbal interaction allowed the interviewer to target specific data collection and to elicit motives behind the answers (Hirsjärvi & Hurme, 2000).

The selection of interviewees was based on a snowball sampling and saturation methods (Hirsjärvi & Hurme, 2000; Berg, 2001). Several relevant and known key informants related to the planning of three districts in the Helsinki metropolitan area were first interviewed (Silverman, 2000). These informants were then asked to suggest associates who would be good sources of LEK information. Many of the suggested interviewees were also connected to the planning of these particular districts, but since the interviewees were asked to express their experiences and views related to LEK use in a more general level in urban planning, the description of the districts is not presented here. This sampling strategy was not truly random, but was used to gather information from individuals knowledgeable about the subject matter (Berg, 2001).

Altogether eleven land use planning professionals (architects, landscape architects, and engineers), three biologists (a consultant, an environmental planner, and a researcher), four representatives of local nature associations (three biologists and a nature photographer), and three local resident activists were interviewed. Considering the research resources (time and money) and the lack of new information in the last interviews (saturation), the twenty-one interviews were considered adequate.

It is accepted that a relatively small number of interviews can cause biases and lower representativeness, but then again the conducted interviews were meant to be in-depth and detailed, to gather more nuanced perspectives. In addition, the sampling and interview methods can result in biased views if not treated critically. Each interview situation is always unique, and it is possible that in another situation the same person could have given slightly different answers (Flick, 1998). The interviewees were aware that the results would be published, and therefore it is possible that they gave "socially desirable" answers. This should be acknowledged when applying or comparing the study findings to other urban areas.

Interviews

The interviewees were given the study's goals and an outline of the interview questions a week prior to the interviews to prepare themselves. The interview questions addressed the following issues: the existence of LEK in urban areas, what kind of residents can be LEK sources, the importance of LEK in urban land use planning, the methods to obtain LEK and integrate it in the planning process, challenges related to obtaining and using LEK, and potential ways to promote LEK in urban planning. The concept of *LEK* was introduced to the interviewees in order to make sure they understood the study's focus. The interviews were carried out on suitable premises during August 2002 - March 2004. The interviews lasted between 60 and 90 minutes and were recorded on Minidiscs, which were later transcribed word-by-word. The interview data were then analyzed using qualitative content analysis (Flick, 1998; Patton, 2002). The data transcribed were first classified by specific themes and categories, and then condensed for the most relevant phrases or parts (Kvale, 1996). The language of the interviews was Finnish and the interview excerpts presented here, in the results section, are translations into English.

Representativeness and Validity

It should be kept in mind that this study's conclusions are based on the results from a relatively small number of interviews from the Helsinki metropolitan area, which means that the situation in different urban areas, and with different participants, may be different. Thus, the study's conclusions cannot be generalized (Berg, 2001), and are merely suggestions about how LEK could work in other urban areas. Although the Helsinki metropolitan area is by no means the largest and most dense urban area in Finland, we believe that some of the same processes regarding LEK could take place in other urban and urbanizing areas. In addition, given the wide experience and deep perspectives of the interviewees on land use planning, the results of this study could work as a starting point for addressing the issue of LEK in more detail and with a comparative approach in other urban areas.

Results

The results are presented according to the following categories: the conceptual meaning of LEK, the importance of LEK in urban land use planning, the ways that planners obtain LEK, the challenges of obtaining LEK through participation, and the challenges of using LEK. Figure 2 illustrates the results in a conceptual flow chart, with the ways of obtaining LEK listed on the left-hand side, and the importance and challenges of using LEK on the right-hand side.

Concept of Local Ecological Knowledge

The interviewees were first asked if they agree with the given definition of LEK. After some minor clarifications, all of them agreed with the underlying concept. The name of the concept itself was not directly familiar to all the interviewees, but understanding the existence and use of such knowledge had already become commonplace to most of the interviewed planning professionals. In addition, some of the interviewees added their own comments regarding the concept (Table 1, excerpts A-B).

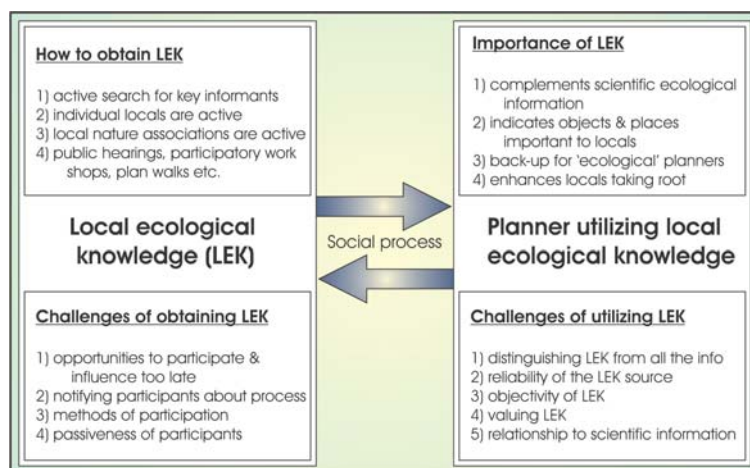


Figure 2. The results in a conceptual flow chart, with the ways and challenges of obtaining LEK are listed on the left-hand side, and the importance and challenges of using LEK on the right-hand side. The feed-back arrow from right to left indicates that the perceived importance of LEK and challenging elements in using LEK also affect obtaining LEK in the first place. This flow of knowledge can be seen as an interactive social process.

Importance of Local Ecological Knowledge in Urban Planning

According to the interviewees, it is essential to consider the knowledge and opinions of people who know the area well, especially if planning aspires to be for the good of local users (Table 1, excerpts C-E). LEK can be an important addition to scientific ecological information and may become increasingly important where little or no nature studies are done in the area. For instance, local users may be aware of occurrences of important species. Population dynamics of certain species may vary from year to year, and local observations during a longer period of time may provide a better basis for decisionmaking.

Table 1 Interview excerpts depicting how the interviewees understood the concept of LEK (A-B) and why they considered LEK important (C-E)

A	"I think this ecological knowledge of people can also be rather emotion-based and subconscious. People who have grown and resided among nature, have an ability, in a way, to feel that nature inside themselves, and that is local knowledge." (planning official, architect)
B	"There are of course different levels of local ecological knowledge. For instance, there is usually a large gap (of knowledge) between nature enthusiasts and true nature experts." (nature association representative, biologist)
C	"When it's about a place with high nature values, the local knowledge, which can only be obtained from users, is important. But how we are able to value this knowledge, it's more difficult. I think it very much depends on planners' decisions, because they are the ones who convey the matter forward and wear it to words and decisions." (planning official, architect)
D	"People who have worked here for longer time have often known about these nature enthusiasts - there have been networks by which these enthusiasts are to be found. If there is a place which is important to people, although there is not a specific nature value, it may have a huge meaning to the people living there." (planning official, landscape architect)
E	"I think local ecological knowledge and nature issues in general will have a significant role in planning in the future. I have seen that 'soft values' have become more popular and there is a kind of new fascination in the nature enthusiasm. Especially as the large age classes become older, they have more time to use and they may want use that in nature." (nature association representative, nature photographer)

The nature enthusiasts interviewed noted that if research information were available, local residents and nature enthusiasts could use these studies to find out more about the species in the area and thus confirm their occurrences. Some of the places important to local users may not necessarily be a habitat of certain species or include specific conservational values, but may nevertheless be of great personal importance. Local nature can be important to local users primarily through the world of experience and only secondarily through species occurrence.

The interviews also revealed that a planner could be under competing pressure from the expectations of his or her own planning bureau and those of residents. In situations when the planner feels that official colleagues criticize her or his views (perhaps too ecology oriented) about area development, arguments from residents can become an important backup.

Furthermore, as an interviewed landscape architect noted, the existence and accumulation of LEK may enhance local residents taking root in their home area, and thus lead to greater appreciation. For example, urban farmers in the vicinity of Helsinki know of several generations on their land, and are thus very much attached to it. In order to create good environments when developing new areas, it is worth listening to the people who are "rooted" in their environment.

Obtaining Knowledge

The interviewed users (planners, consultants, and environmental officials) can obtain LEK in several ways. First, they can actively look for local residents and enthusiasts who are interested in, and knowledgeable about, nature in the plan area. Second, residents and other participants, on their own initiative, can contact planning officials by means of statements or through a participatory process (Table 2, excerpts A and B). According to interviewed planners, persons knowledgeable about local nature, and at least somewhat familiar with scientific ecology, are the best sources (Table 2, excerpt B). More experienced planners may know several nature enthusiasts

in the city, and additional knowledgeable and collaborative persons can be found as needed through personal networks (Table 1, excerpt D). However, establishing such local contacts may be a long-term project (Table 2, excerpt C).

In addition to individual participants, knowledge can be found within local nature associations, which are important contacts, especially as information sources, but also because of their ability to gather, store, and distribute species information over time. For instance, if nature studies are to be made in the district, the associations can help in informing local nature enthusiasts about the need for additional information. Quite often nature associations will write their own statements regarding the plan. According to representatives of nature associations, people who have come to know an area's nature, for instance through hiking, contact them. However, although they know the area thoroughly, they often feel that they do not have enough theoretical expertise to support their views. For instance, if they think that a particular area should be protected, the nature association could be an expert party, whose statements can weigh more than those of individual residents.

Public hearings that incorporate participatory planning process are forums where certain themes can be discussed publicly, and matters regarding nature are more often reviewed (Table 2, excerpt D). However, the interviewed representatives of nature associations also criticized public hearings and participatory workshops (which will be addressed later). Furthermore, the interviewed planners emphasized the usefulness of 'plan walks,' where planners and local participants walk a route in the plan area and stop in places regarded as important. Participant comments, such as that "there are many frogs and snakes here in springtime," are written down as planning information.

Urban residents are heard both at the detailed and master plan levels. According to the interviews, residents are often more interested in the detailed plan level, unless the master plan concerns their own neighborhood. Here the difference between residential districts becomes clear; residents in certain areas are more active than elsewhere, possibly due to demographics. This applies to activities concerning green spaces, but also to challenges regarding participation and interaction. Perhaps due to the "my own backyard" principle, matters regarding nature are discussed more often with residents during the detailed planning process, when specific resident knowledge can be considered.

Table 2 Interview excerpts depicting how the interviewed planning professionals obtain LEK (A-D), and the challenges of obtaining LEK through participation (E-H)

A	"We try to keep a small unofficial register of nature enthusiasts in Vantaa, whose observations are important to us, and can even give new information on some species. For instance, if a chicken hawk has been seen nesting somewhere in Vantaa - it is rare. Sometimes this kind of information can be very knowledgeable, because a lot of nature specialists live in Vantaa. But given that we have many such experts here, they seem to be rather passive about their own environment and contacting us." (environmental planner and biologist working at a local environmental center)
B	"I have received maps and letters, had conversations, it has all been good. However, the best collaboration I have had with such local residents who have been somewhat or well familiarized themselves with scientific ecology." (planning official, landscape architect)

C	"It is a result of rather long-term work to find right and co-operative persons. The knowledge is compiled as small narratives, but often and unfortunately they stay just between the ears of planners. But that is part of the data we collect, and when the decisions are made, I argue that all those narratives have their own effect. Although we can't write down all of them, the image we get about the situation comes both from the discussions with residents and facts." (planning official, architect)
D	"In my opinion it is not so terribly difficult to bring ecological knowledge out in the open - nature matters often come up more easily than social matters." (planning official)
E	"Residents should be able to participate the planning process at very early stage. If a planner has already done a lot of work with the plan and formed a strong vision/opinion about the plan, it is harder for outsiders to influence it ... it's the planner's baby!" (resident activist, retired architect)
F	"Public hearings or discussions are often kind of eyewash, not very useful for us nature associations - people who really know do not have a change or time to express their knowledge there. We can better influence by written statements." (representative of nature association, biologist)
G	"Resident associations are active but they often mainly care about their own 'backyard' and work very purposefully in that sense. It is better for nature associations to keep the distance from their territorial battles." (representative of nature association, nature photographer)
H	"Local ecological knowledge easily stays between the ears of a person. The knowledge may exist, but these people have to also be socially active in order to bring out the knowledge. There are a lot of nature enthusiasts who are "lone wolves" - they don't much talk to anybody, but may nevertheless have a massive knowledge base." (resident activist, nature photographer)

Challenges of Obtaining Local Ecological Knowledge Through Participation

The interviews revealed that residents and nature enthusiasts often think that influencing the plan with their opinions and knowledge is rather difficult. One challenge seems to be timing; when a sketch of a new plan is introduced to the public, a certain number of basic conditions have already been determined, such as the master plan, aim of surface area to be built, and architectural vision. The planners are judicially obliged to consider the participants' information, but if reservations have already been made regarding the construction, the new information cannot affect the plan proposal or the final implementation (Table 2, excerpt E). According to the legislation's spirit, participants should be viewed as partners in the planning process; however participants sometimes perceive themselves as competitors with planners. But as was mentioned, even if planners would like to incorporate LEK, their hands can be tied by earlier decisions.

Another challenge, according to the interviews, is notifying the participants publicly about the plan. Planning officials inform the public concerning the availability of plan preparation material, but these information channels do not always reach all interested parties. Local residents, and other participants, may feel that the release of information is inadequate or late. Participants have to keep their eyes and ears open, or they may read in the newspaper that the plan has just been approved. Participation requires devotion, tenacity, and interest in urban development.

Yet another challenge is the method of participation. Public discussions are aimed at all interested parties, but it is rather uncommon that all participants are able to attend the forums at the same time. As excerpt F in

Table 2 shows, some participants perceive that other methods of influencing the plan are more useful than public discussions. The success of the plan workshops depends largely on the kind of individuals that represent the local people and on their motives and values (Table 2, excerpt G). Furthermore, LEK can be obtained actively by means of questionnaires, which, as emphasized by the interviewed planners, need to be very clearly written. Moreover, it is not a given that the answers cover a wide enough array of residents to provide balanced information. The loudest opponents may well get their voices heard, while those who are satisfied stay silent. When considering all the obstacles, people may feel that influencing the process is very difficult, and if their opinions do not count much, they may stop participating.

As several interviewees noted, there is a vast amount of LEK and ecological expertise about Finnish urban areas, but in order to use that knowledge, its holders have to be active participants. One reason for passivity (Table 2, excerpts A and H) can be the challenge of presenting knowledge and opinions publicly and in a language that can be understood by decisionmakers.

Challenges of Using Local Ecological Knowledge

Although much LEK can be available, the interviewees regarded using the knowledge as challenging. Planners receive a variety of information and opinions through public hearings, workshops, written statements, and other methods of communication. However, it is challenging to analyze the information in order to use it in the plan. Received information regarding local nature may vary from opinions, feelings, and experiences to very knowledgeable species observations and well-founded perspectives on the development of urban green areas. Although all of these can be useful for the planner, it is sometimes difficult to recognize accurate ecological knowledge, such as observations on species and biotopes and their functions.

Planners prefer well-founded and reliable knowledge, but they must be able to determine how reliable the knowledge source is (Table 3, excerpts A-C). The interviewed planners emphasize that local knowledge must be treated critically, because it may easily contain inaccuracies. In the case of species or biotope observations, planners principally trust LEK sources, and this information can be verified on location if necessary. The situation becomes more difficult if the observation is several years old, because circumstances may have changed. However, an old observation may indicate that the area is of potential importance for biodiversity. If the local green spaces are obliterated or altered, the species lose their potential habitat.

Table 3 Interview excerpts depicting the challenges of using LEK

A	"Obtaining the knowledge and its reliability are challenges; if a resident tells about personal observations, it may not be as reliable as information from a consultant. But at least knowledge from residents would set ground for consultant studies - so I think that local ecological knowledge should be included in planning." (planning official, architect)
B	"Whoever has produced the information of a species or other matters, it has to be critically assessed in what kind of circumstances the observation was made in - some know species better than others, some are into birds for instance, and their observations are of course more credible. Lay observations are more uncertain, but have to be checked

	because the observation may nevertheless be just right." (biologist working as consultant)
C	"We have the background assumption that local residents are the experts of their own living environment; and we thus ask for all observations, also clearly about the nature. I don't know what would be the method that would increase ecological knowledge or matters related to it coming up. And reliability; perhaps our environmental center could be used to verify that information." (planning official, architect)
D	"Science, beliefs, and interests are mixed together in the local ecological knowledge, and it makes it hard to value the knowledge. Matters that do not seem to fit into a situation may be left unmentioned unintentionally or half-unintentionally." (planning official)
E	"I think that opinions, emotional matters and aesthetics are strongly a part of the local ecological knowledge - they clearly shape the knowledge for everyone, which is not necessarily a bad thing (to certain limits). Based on opinions, the individuals can start looking for more information and thus gain more knowledge." (representative of nature association, biologist)
F	"Often the knowledge of nature enthusiasts is kind of common knowledge, like for instance I have. The knowledge of a specialized researcher is number one compared to that. But even an enthusiast finds, because the professional researcher does not necessarily step on the very place where something grows or is to be found. However, without the research fact and the judicial power it brings, there is just a battle of values on what should or should not be preserved." (representative of nature association, nature photographer)
G	"It is very important that planners and decision-makers receive opinions and knowledge on nature from residents, particularly because the people in Finland have strong views on ecology and nature. These views should not, however, affect too overwhelmingly to decision-making, but the ecological questions in the planned area should be answered mainly based on scientific ecological expert information." (representative of nature association, biologist)

The issue of knowledge reliability and validity is related to its objectivity and subjectivity, and therefore to how it is valued. The interviewees often regard LEK as subjective (associated with opinions and feelings), which creates challenges in how to use the knowledge (Table 3, excerpts D-E). LEK can be very emotional, because ordinary residents may not be able to argue clearly about their experiences and opinions. However, as the interviewed planners note, emotional stances have their reasons, and a good planner tries to interpret what is at the root of these emotional outbursts. Furthermore, local participants can appreciate different elements of nature in different ways. For instance, for some residents certain trees can be close and familiar, i.e., associated with numerous memories, whereas others may see the same trees as "just shading." A planner, however, has to take both into consideration as a part of the planning process. The different perspective of each resident may thus become a dilemma for the planner who tries to incorporate these conflicting messages.

What type of emphasis and value should LEK have, compared to scientific research information collected and produced by ecological experts, such as biologists working as consultants? Ecological research information is usually considered objective and the "best available" information (Table 3, excerpt F). However, sometimes its reliability and objectivity have to be scrutinized, especially if the studies are made within a relatively short period of time or by inexperienced consultants. In these cases, LEK can be more reliable than an official study. Nevertheless, the presence of a nature conservation area next to the plan area requires official research information or at least very

specific LEK (which has to be scientifically verified anyway).

Due to the wide spectrum of lay-expert knowledge, some interviewed planners and biologists note that, from the city planning perspective, ecological expert information and lay participant knowledge and opinions should be processed and valued separately and then weighed against each other. Excerpt G (Table 3) depicts the relationship between "research information" and LEK from a biologist's viewpoint.

Discussion

Types and Categories of Local Ecological Knowledge

Based on this study's results, we developed a model that has five *types* of LEK, in order to understand the wide spectrum of such knowledge (Figure 3). Placing an individual under a certain type is highly context-dependent; for instance, an individual can be an ecological specialist and not possess local special knowledge. The descriptions of the different types of LEK include the degree of nature enthusiasm and participation and the related organizations that an individual may belong to.

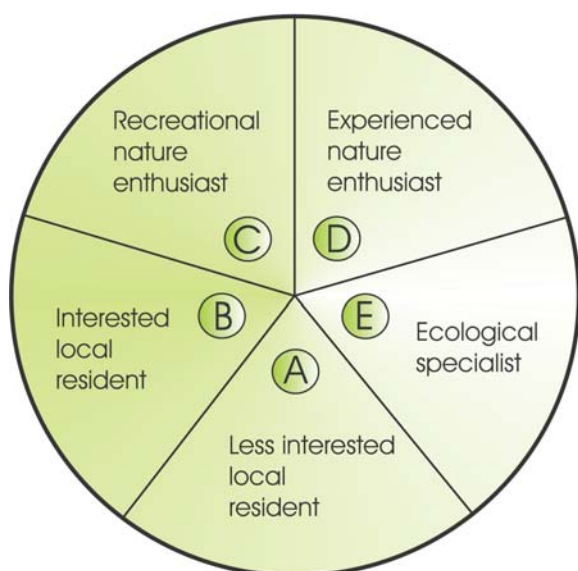


Figure 3. Five Types of Local Ecological Knowledge (LEK).

(A) Less interested local resident; does not use local nature for recreation or otherwise, does not know or care much about (local) urban nature or nature in general (although may appreciate and have knowledge on pristine nature), does not care to participate locally. Related organization: none usually.

(B) Interested local resident; does not much use local nature, but still regards it important and has some knowledge and opinions about it, may participate to some extent. Related organization: sometimes 'local agenda' or resident association.

(C) Recreational nature enthusiast (local resident or a non-local user); a moderate use of local nature, has basic nature knowledge, has learned to know the area quite well by recreational use, enjoys being in nature, may participate. Related organization: 'local agenda' work group or resident association.

(D) Experienced nature enthusiast (local resident or non-local user); has good general and local nature knowledge, may know some taxa quite well (e.g. birds, butterflies), has will and time to participate, may belong to a nature association. Related organization: general (or local) nature or environmental association (e.g. city level).

(E) Ecological specialist (local resident or non-local user); high level of special knowledge of certain taxa or species, or ecology in general, usually through profession or/and long-term enthusiasm, may not always have time or will to participate, few in numbers, valuable support

for local enthusiasts. Related organization: specialized nature association (e.g. birds or insects).

Our study also indicated that certain *elements* of LEK could be found in almost all types of LEK. We have categorized those elements as follows:

1. Observations on local species and biotopes (patterns of nature) and their function (nature processes), including both spatial and temporal variability – embedded in all types of LEK except A, and emphasized in types D and E.
2. Single local nature entities, such as objects that are familiar and valuable to participants (e.g. forest patch, meadow, brook, tree) – important in all types of LEK except A.
3. "Emotional matters," such as opinions, feelings, and aesthetic values that can also result in silent or hidden appreciation of local nature, or a lack of appreciation – relevant in all types of LEK, also in A. Both 2 and 3 include temporal variability – residents today may have different values than residents 20 years ago.

An important issue in using LEK is how end-users are able to separate observed elements (categories 1 & 2) versus elements related to aesthetics and feelings (categories 2 & 3). Opinions and subjective viewpoints are important, and it is not always possible, or even necessary, to separate them. However, as the interviewed planners emphasize, if LEK's observational elements are to complement ecological research information, the planners have to be able to distinguish natural scientific knowledge (such as what grows or lives where and when, and how these patterns have changed over time) from what participants regard as valuable.

Furthermore, it is difficult to determine who has the right to decide which observational elements are most important (Söderman, 2003), or if the observational elements are more important than opinions, or which opinions are most important. Planners face this challenge when balancing different values related to plan areas. Today in Finland, certain species and biotopes are perhaps regarded as more valuable than just beautiful or revered landscapes or natural objects. This may be because 'observational' information is easier to measure and legitimize than more aesthetics-based, and thus more subjective, information. Nevertheless, quite often these elements of LEK are tightly linked in an individual participant, as captured by the words of a nature enthusiast: "apparently nature appreciation is a kind of 'all-inclusive package'; it includes both the species and the aesthetics they bring with them."

Meeting the Challenges of Local Participation: Obtaining and Using Local Ecological Knowledge

Harrison & Burgess (2003) suggest that contextualized perspectives from local communities offer new insights about how individuals are engaged with society, and how more effective strategies for environmental communication and decisionmaking can be developed with participatory approaches. But this study demonstrates that such a participatory lifestyle is not suitable for all residents, since they often do not have enough resources, such as knowledge, time and skills, to participate effectively or at all. Moreover, other life

situations can result in lack of participation, even if the residents could have relevant knowledge for planners. Moreover, if a resident puts time and effort into participation, many barriers often block actual influence. Such lack of success can lead to passive and frustrated attitudes toward participation (Arola, 2002). One solution is offering participants information, training, literature, and counseling (Paldanius, 1997). Lapintie (2002) noted the following challenges, which are familiar to all who have been involved in public participatory hearings or forums: too few participants given the extent of the impacted population, difficulties in finding a common language, hostility awakened by a too-complete plan sketch, and participant attempts to prevent any changes in their local environment (see also Fagence, 1977).

Finding the right communication methods is one of the central issues. Although the knowledge and opinions of local participants might be expressed in a "common" language, with less sophisticated terms and arguments than planners or decisionmakers use, the critical and deeply complex issues fundamental to the society-nature relationships and their transformation to planning decisions are voiced in local words (Davies, 2001; Yli-Pelkonen & Niemelä, 2005).

Thus, it is necessary for planners in a participatory process to understand appropriately the language of locals (see also Bäcklund, 2002; Staffans, 2004). This may not be a simple task, especially with ecological issues, due to the complexity of ecological systems and their value-laden understanding both to planners and locals (Kilvington et al., 2000). While planners are experts assigned to lead the planning process, they have to be ready to consider participants' thoughts, knowledge and values, and through their own expertise "filter" this information for planning and decisionmaking purposes. At times, it can be challenging for planners to cope with the uneven distribution of knowledge and activities of different focus groups. As Davies (2001) notes, "the big question is, how is it possible to consider the range of different views to make a just and equitable decision." In order to develop methods to cope with these challenges, and to control both the ecological and social impacts of land use change, social scientists need to be involved in the planning process (Sairinen 2004; Sairinen & Kohl, 2004).

When developing participatory methods in urban planning, local participation should be innovative i.e. produce new knowledge with the special role of experiential knowledge, and communication should be as open and transparent as possible, so as to strengthen local democracy (Staffans, 2004). The participation process in planning projects is often bound to time (periodic); nevertheless, there should also be more established and continuous practices for participation to support and build a foundation for the periodic processes.

In order to help lay participants (mainly LEK types A-C) to articulate their ecological knowledge and opinions as part of the planning process, participants should become more familiar with scientific ecology and with language used by ecologists and planners (Weber & Word, 2001), and also develop general skills of interactive participation and argumentation. Small technical solutions, such as better visualization, could improve the chances of LEK reaching the end-users' attention (Tyrväinen et al., 2003). For instance, it would be more illustrative if participants sent planning officials their observations, experiences, or opinions in map form, with additional

comments attached. It would be rather easy, then, for the officials to check the situation on the marked location, if needed. In this way, LEK use could shift from Callon's model M1 towards models M2 and M3.

Slightly different measures apply with LEK types D-E, where Callon's models M2 and M3 are potentially already working. As was noted, a vast number of specialists and nature enthusiasts with various interests dwell in urban areas. Local environmental centers (potentially in association with local nature associations) could keep a register of those nature enthusiasts, who could work as key informants, as is being done in some cities. This would direct important knowledge to city officials, while at the same time preventing controversies in advance.

Urban planning could take into account more specialized ecological knowledge available in the national archives (e.g. data collected by bird enthusiasts) (Söderman, 2003). This would require better communication between city officials and nature associations with these useful archives, and connection with GIS based municipal databases (e.g. Pedersen et al., 2004). In their own right, the specialized nature associations can use their own networks of local enthusiasts to monitor and respond to new plans in a wider area. For instance, a Helsinki-based bird-watchers association is setting up their own 'plan board,' in which bird enthusiasts all over southernmost Finland are networked. In each smaller area, local enthusiasts would take responsibility to monitor all the planning and inform the board about needed statements. Such large-scale networking requires extensive voluntary work and is thus not easily implemented.

This study gives some support to the theoretical assumptions of the LEK models, although the design limitations presented in the methods section have to be kept in mind. According to this study, all the LEK models (M1, M2a,b, and M3) presented are visible in the Finnish urban detailed planning process, depending on the planning project and LEK type in question. Model M1 prevails when decisionmaking requires strictly official research information (e.g. due to a nature conservation area next to the plan area), or when participants are not able to transfer their potential knowledge to end-users. Reasons for the latter can be: (1) participants or planners think that there is not enough usable LEK available, (2) usable LEK is available, but the participants are not able to present it coherently to planners, (3) usable LEK is available, but even though the participants are able to communicate it, the planners, for some reason, do not use it.

Model M2 (a,b) works when (1) both participants and planners see that such LEK, which complements ecological research information, is available; (2) participants are able to bring their LEK forward in the participatory planning process; and (3) planners are able to obtain LEK from participants according to the principles of participatory planning. This seems to work best with LEK types D-E, but types A-C are also considered. The potential non-transmittance of LEK to the final plan decision remains a problem. Model M3 can work in situations where ecological research information is scarce, and LEK (mainly types D-E) is known to be available. Nevertheless, this calls for informed and communicative planners and participants, who have the time and will to participate.

Conclusions

Based on Finnish legislation, land use planners must consider the knowledge of local stakeholders, who have information on an area's biodiversity, in addition to scientific ecological studies. This article presents study results that support Local Ecological Knowledge (LEK) in urban areas and its importance in land use planning. The study's findings indicate that land use planners can obtain LEK from local key informants and nature associations. Based on the findings, the individuals who possess LEK can be roughly divided into five different types: less interested local residents, interested local residents, recreational nature enthusiasts, experienced nature enthusiasts, and ecological specialists. LEK from all these types can be useful to planners, although LEK from more experienced nature enthusiasts and specialists is regarded as easier to interpret. Moreover, almost all these types possess elements of LEK that can be categorized into species and biotope observations, single nature objects valuable to individuals, and emotional matters (opinions and aesthetic values).

Considering LEK in urban planning is important because it can complement ecological research information and indicate objects and places important to stakeholders. Collecting LEK faces numerous challenges, many of them related to general difficulties of public participation. The challenges found in using LEK include distinguishing LEK from other information, valuing subjective knowledge, and the capability of planning officials to use it. In order to develop methods to meet these challenges and control both the ecological and social impacts of land use change, social scientists should be integrated into the planning process. With help in participant and planner communication, planners could better learn to interpret LEK of all types. Furthermore, technical improvements, such as key informant registers and more efficient use of nature association knowledge, would be useful. We hope that this study's findings can work as a starting point for land use planners and other stakeholders in facilitating better understanding of the role of LEK in urban planning.

Even if all the measures that we present as ways to advance LEK use, and to complement scientific ecological information, were implemented, the core issue still is *how* the knowledge is finally used (Olsson & Folke, 2001). If, alongside scientific information, LEK is available, and the tools to obtain and use it exist, decisionmakers still need the will to enhance sustainability by maintaining a certain amount of urban green space with a certain "ecological quality level" under the pressure of planning new residential areas for the growing urban population. This will largely depend on the prevailing values of urban residents, key professional actors, and, perhaps most importantly, politicians.

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